

**QUALITY OF ANTENATAL CARE IN VIET NAM:
AN ASSESSMENT FROM A MULTIPLE INDICATOR
CLUSTER SURVEY**

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ABSTRACT

Background

Equitable and high-quality antenatal care (ANC) is essential in improving maternal and newborn health. Yet the global benchmark indicator for antenatal coverage, at least four ANC visits, is not sufficient to capture key interventions provided during ANC for women. This study proposes an alternative to track maternal health program performance in Viet Nam and to identify maternal health factors associated with the receipt of quality ANC in this population.

Methods

We conducted secondary analysis of 1340 women using data from the Viet Nam 2013-2014 Multiple Indicator Cluster Survey 5. Quality ANC was defined as that which included all five recommended components: blood pressure measured; urine tested; blood sample taken; full tetanus vaccination given; and iron-folate supplementation provided for at least 3 months.

Results

We found that 80% of women had adequate ANC in terms of having four or more visits (ANC 4+), yet less than half received an acceptable quality of care in terms of receiving all five recommended components. Although ANC 4+ was associated with higher odds of receiving quality ANC, it did not ensure the provision of quality ANC services. Further, lower odds of receiving quality ANC were found among women with lower levels of education, lower economic status, or living in the southern and northern mountainous areas.

Conclusions

It is time to adopt a more effective coverage indicator that can reflect the proportion of the population in Viet Nam in need of ANC service and demonstrate that those in need have received it with adequate quality. At the same time, continuous efforts are needed to improve inequity in the delivery of quality ANC among disadvantaged women in Viet Nam to ensure access to quality ANC service for all.

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BACKGROUND

Antenatal care (ANC) is one of the proven interventions across the continuum of care to promote maternal and newborn health (1). ANC services aim to identify and prevent conditions that can impact the health outcomes of both mothers and their children. Good care during pregnancy is important to prepare for birth and parenthood and to prevent adverse pregnancy outcomes through early detection, alleviation, and/or management of potential health problems that may affect mothers and babies during the critical time of pregnancy (2). Effective ANC is vital, as it has been estimated that one-fourth of global maternal deaths occurs during pregnancy (2, 3). Women in developing countries are also highly likely to give birth in health facilities if they receive antenatal care (3,4). In addition, two-thirds of stillbirths, which account for more than half of all perinatal deaths, take place before the onset of labor (2, 3). Finally, the effects of ANC go beyond the period of pregnancy and childbirth, providing opportunities for integrated interventions such as prevention of mother-to-child transmission of HIV, family planning, nutrition counseling, detection of sexually transmitted infections, or identification of intimate partner violence (2, 3).

At the beginning of the 2000s, the World Health Organization (WHO) recommended a four-visit model of focused ANC for healthy pregnant women in low- and low-middle-income countries (2, 3, 5). This goal-oriented model requires a minimum of four visits at the correct times during a pregnancy (1st visit before 4 months, 2nd at 6-7 months, 3rd at 8 months, and 4th at 9 months) and emphasizes what must be done at each visit to provide essential ANC interventions such as screening for maternal illnesses, hypertensive disorders of pregnancy, and anaemia; iron and folic acid supplementation to prevent

maternal anaemia; tetanus immunization; health counseling and education(1, 5). This recommendation was based on a multi-country randomized controlled trial and a systematic review led by the WHO, which showed that a focused ANC model, compared to a traditional model consisting of 12 visits, has been as effective in terms of clinical outcomes, is more cost-saving and is more applicable in limited resource settings (6).

Since then, universal access to ANC measured by number of visits has been used as a global benchmark to track countries' progress towards maternal and newborn mortality targets for Millennium Development Goals (MDGs) (7). In particular, ANC coverage with at least one visit (ANC 1+) by skilled health personnel is taken to signify universal access to reproductive health, and ANC with four visits or more (ANC 4+) is considered a proxy for adequate ANC (7, 8). However, the effectiveness of ANC depends on an ability to deliver needed services that are accessible and to provide high-quality care. A 2015 report by the World Health Organization on 75 countdown countries revealed that the “number of visits” benchmark fails to capture information on services actually provided, even in countries with a high distribution of ANC visits (8).

To date, the effectiveness of the WHO's focused ANC model is still ascertained based upon information in the currently available literature. A 2010 updated Cochrane review and a 2013 further analysis of the original WHO trials found that this reduced-visit ANC model is associated with a 27% higher risk of fetal deaths when compared to the traditional ANC model that specifies a median of eight visits (9, 10). These findings highlight the importance of careful monitoring of maternal and perinatal outcomes while implementing the recommended model (9, 10). Following this trend, AD Hearn and co-authors in their 2015 review examining the successes and challenges of the focused ANC

model concluded that current indicators using numbers of visits and/or content of care were problematic and that there was a need to improve measurement tools for better monitoring and evaluation of the quality of care (11). Conjointly, a study analyzing recent Demographic and Health Survey (DHS) data from 41 countries pointed out that although the number of ANC visits did correlate well with the number of elements of care received, there were remarkable quality-coverage gaps in antenatal care using the ANC 4+ indicator to evaluate national maternal health program performance (12). Based on that fact, the authors proposed that an alternative indicator could be *“the proportion of women who report receiving the full set of specific elements of care,”* which were defined and prioritized by local policymakers and programme implementers and which could also be readily collected from national surveys such as the DHS and Multiple Indicator Cluster Survey (MICS) (12). For global comparison, this quality indicator could be restricted to common content elements (i.e., blood pressure measured; urine tested; blood sample taken; full tetanus vaccination received; and iron-folate supplementation provided for at least 3 months) of the ANC package across all countries (12).

Viet Nam is one of ten fast-track countries working towards MDGs and showing remarkable reductions in maternal mortality, which has dropped from 233 to 54 per 100,000 live births from 1990 to 2014, with infant mortality dropping from 58/1000 to 17/1000 live births between 1997 and 2014 (13). These trends were associated with improved implementation of effective interventions such as skilled birth attendance, which increased from 77% to 93%, and an increase in women accessing ANC care from 71% of women with ANC 1+ in 1997 rising to 94% by 2014 (8, 13). Despite these positive results, the literature is overflowing with observations that there is a significant inequity in ANC

utilization (14-18). Specifically, minority ethnic status, low educational attainment, low economic status, rural, remote and mountainous residence, were all factors associated with more limited access to ANC.

In Vietnam, most previous studies on ANC have concentrated on two aspects of utilization (the number visits and the timing of the first ANC visit). Few studies have examined the content of ANC (14, 18, 19). Very few studies have examined the overall adequacy of ANC among geographic sub-populations (20, 21). For instance, the first study addressing ANC adequacy was conducted in only three provinces in southern Vietnam and defined ANC adequacy based on a complex index of frequency of ANC utilization and four levels of reporting on ANC components received (20). Another study carried out only in northern Vietnam proposed an index that combined three indicators (number of visits, the timing of the first visit, and sufficient components received) as measures for the adequate use of ANC (21). All of these studies were based on self-designed questionnaires, making them unsuitable for both national and global monitoring and evaluation.

The purpose of the current study is to propose a better measurement to track ANC program performance and to use maternal socio-demographic characteristics to examine how high-quality ANC is distributed in Vietnam. These findings will provide meaningful guidance in the formation of national maternal policies and programmes to reduce preventable maternal and child deaths in Vietnam. In this study we examine the following research questions: (1) Is the ANC coverage indicator “the proportion of pregnant women receiving 4 or more ANC visits” an effective measure capturing high-quality service provision (receiving all five recommended components)? (2) What are the social-demographic factors associated with the receipt of quality ANC as defined by receiving all

five recommended components among pregnant Vietnamese women? We hypothesize that an adequate number of ANC visits alone will not guarantee the receipt of key interventions. Women who receive four or more ANC visits will not necessarily be more likely to have received all five components compared to women who received less than four visits. Second, we hypothesize that the delivery of quality ANC will vary across maternal socio-demographic characteristics. For instance, women from remote and mountainous areas will be less likely to receive all five components and thereby will be more likely to have a lower quality of care.

METHOD

Study data

This study is a secondary analysis of individually recoded data from the 2013-2014 Viet Nam MICS 5 (22). This household survey was carried out as part of the global MICS program that was developed and designed by the United Nations Children's Fund (UNICEF) to collect internationally comparable data on a wide range of indicators tracking maternal and child health. A stratified two-stage cluster sampling design was used to obtain a nationally representative sample of 10,200 households for the survey. From the interviewed households, 9,827 women of reproductive age (15-49 years old) were successfully interviewed, yielding a response rate of 96.4 percent. We restricted our analyses to the 1,484 women who had a live birth within the two years preceding the survey. A final sample of 1,340 (90%) women with no missing data on covariates of interest was included in our analysis. Approval to use the data was given by the UNICEF MICS Team.

In the Vietnam MICS, all women with a live birth in the two years preceding the date of interview were asked a number of questions about antenatal health care. Information was collected about the types of providers, the numbers of ANC visits, the timing of the first ANC and the five basic components of the ANC package. These components were: blood pressure measured, urine tested, blood sample taken, tetanus injection received, and iron-folate supplements provided (22).

Measurements

In this study, the main outcome variable is the quality of ANC, defined as including all five recommended components of ANC in Vietnam: blood pressure measured, urine tested, blood sample taken, full protection against tetanus provided, and iron-folate supplements for at least 90 days supplied. All of these components have also been recommended or investigated in previous studies (12, 23-25). According to both the WHO and national guidelines, the first three components are critical to monitor for pregnancy-induced hypertension, anemia, and bacteriuria; the two preventive care services (tetanus vaccination and provision of iron-folate supplements) are recommended for all pregnancies (26, 27). The main outcome of interest was dichotomized: either women received quality ANC or they did not during their most recent pregnancy.

The main independent variable was the number of ANC visits, which was divided into two groups: at least four visits and less than four visits. Additional descriptive variables about ANC included timing of initiation of care and type of ANC provider. Women's timing of ANC initiation was reported as a specific week/month of their pregnancy, which was dichotomized in this study as within or later than the first trimester. Types of ANC providers included five possible responses that were grouped into two categories as skilled

health professionals (doctor, nurse/midwife) and unskilled providers (traditional birth attendant, village health worker, and other), according to the WHO's definition (7).

The following social-demographic characteristics of the respondents were considered for their potential association with the receipt of quality ANC: region, place of residence (urban, rural), household wealth quintile, age, ethnicity, education, and parity. In the survey, regions were designated as Red River Delta, Northern Midlands and Mountainous areas, North Central and Central Coastal areas, Central Highlands, South East and Mekong River Delta; these were categorized the way they were collected. The quintile of the women's household wealth was a composite indicator which divided households into five categories: poorest, second, middle, fourth and richest, based on a principle component analysis using information on the ownership of consumer goods, dwelling characteristics, water and sanitation, and other characteristics related to household's wealth (21). Age of the mother was reported discretely and categorized in this study into three groups: 15–19, 20–35, or 36–49. In the survey data, ethnicity of household heads was already divided into two categories of codes (Kinh and non-Kinh). Women's educational level was categorized into 6 levels that were collapsed in this study into three categories: none or primary, secondary (lower and upper secondary), and a higher level of education (professional school, and college/university and above). Maternal parity was assessed as the total number of children ever born, and grouped in our analysis into less than or equal to two children and more than two children.

Statistical analysis

Descriptive statistics (frequencies and percentages) and bivariate analyses including Pearson chi-square tests were used to examine the distribution of socio-

demographic data and ANC utilization characteristics of the respondents during their most recent pregnancy. To test the first research question—whether the ANC coverage indicator “the proportion of pregnant women receiving 4 or more ANC visits” is effective in capturing information on the actual contents provided during those visits—the proportion of pregnant women with 4+ANC visits was compared with the proportion of those who reported receiving all five ANC components.

To answer the second research question—which social-demographic factors are associated with the receipt of quality ANC—binary logistic regression models were run to examine the relationship between quality ANC (all five service components received) and each of the other indicators of ANC utilization (timing of the first ANC and types of ANC providers) as well as socio-demographic variables, reporting unadjusted odds ratios (OR) and 95% confidence intervals (CI). Any factor (socio-demographic and other ANC-related variables) that was statistically significant at the bivariate level ($p < 0.05$ in the Person’s chi-square tests or in the crude logistic regression models) was included in the final multiple logistic regression model to examine whether these relationships persist after adjusting for each other. Adjusted odds ratios (aORs) and 95% CIs are reported from the final model. We used Stata version 14 (*Release 14*. College Station, TX: StataCorp LP) to analyze the data. All analyses were adjusted for sampling weights.

Ethical considerations

This study was reviewed and deemed exempt by the Institutional Review Board at the University of North Carolina at Chapel Hill.

RESULTS

The proportion of women who had quality ANC, defined as having received all five ANC service components, was 48.3% (95% CI: 44.5-52.0%). Blood pressure measurement was the most commonly offered component (86.1%), followed closely by full protection against tetanus (84.9%) and receiving iron-folate supplementation for at least 90 days (81.7%). Urine testing was provided to 75.3% of the women. Lastly, 64.9% of pregnant women had blood samples tested, as shown in Table 1.

Table 2 reveals that 78.3% of women had at least four ANC visits during their most recent pregnancy. It further shows the distribution of quality ANC by maternal characteristics. Most women initiated ANC early in the first trimester (85.8%). There was no variation in types of ANC providers, as nearly all of them received ANC from skilled providers (99.8%), thus, this variable was not included in the logistic regression analysis. A higher proportion of women with four or more visits received quality ANC, compared to those with fewer than four visits (56.0% vs. 20.4%). Looking at the socio-demographic characteristics, urban areas had a larger proportion of women receiving quality of care compared to rural areas. Regionally, rates of receiving quality ANC were lowest among women of the Central Highlands (18.2%) and the Northern Midlands and Mountainous area (22.8%). Quality ANC was reported more often among women from wealthier economic quintiles, Kinh-ethnicity, higher educational levels, or with fewer than three children.

The bivariate logistic regression found that all predictor variables except maternal age (Table 3) were significantly associated with the quality of ANC received, and, therefore, this variable was also not included in the multiple logistic regression model. Our final

results from the multivariate analysis found that women with four or more ANC visits had 2.47 times the odds of receiving quality ANC compared to those with less than four visits (aOR = 2.47, 95% CI: 1.66-3.67). In the same pattern, maternal education was significantly and positively associated with receiving quality ANC. Particularly, the odds of receiving quality ANC among women with secondary or higher levels of education were 1.94 and 2.56 times the odds of those with no formal or only primary-level education (aOR = 1.94, 95% CI: 1.29-2.92; aOR = 2.56, 95% CI: 1.52-4.33, respectively). Women from richer wealth quintiles also had increased odds of receiving quality ANC compared to those in the poorest quintile (aOR = 2.10, 95% CI: 1.18-3.72; and aOR = 3.02, 95% CI: 1.54-5.94, respectively). Finally, the odds of receiving quality ANC among women living in the Northern Midlands and Mountainous area was 45% lower and in the Central Highlands was 54% lower than that among Red River Delta women (aOR = 0.55, 95% CI: 0.32-0.97; aOR = 0.46, 95% CI: 0.27-0.77, respectively). Conversely, women in the Mekong River Delta or the Southeast all had higher odds of receiving quality ANC compared to those in the Red River Delta region. In the final multivariate model, maternal factors including timing of the first ANC visit, rural versus urban place of residence, and maternal parity were no longer significantly associated with receiving quality ANC.

DISCUSSION

This study found that less than half of all pregnant women in Viet Nam received quality ANC defined as receiving five essential service components, as compared to nearly 80% of this population who were considered to have had adequate ANC on the basis of having at least four ANC visits. We also identified that the number of ANC visits, maternal

education, maternal wealth status, and geographic region were significantly associated with the receipt of quality ANC in the country.

As our analysis demonstrates, the current standard of using the number of visits to measure national ANC program performance is not sufficient to reflect the delivery of truly effective care in Viet Nam. Ineffective care means missed opportunities to achieve better health outcomes. Our finding was consistent with previous studies done in Nigeria and Nepal and one secondary analysis of 41 DHSs (12, 24, 25). In Nepal, although half of pregnant women had ANC 4+ visits, only 24% reported quality care with seven service components received (25). The result of the Nigerian study was more striking, as 81.5% of ANC users had at least four visits, but only one-tenth received eight critical components determined to constitute the minimum acceptable quality of ANC (24). Not surprisingly, among 41 DHSs (not including Viet Nam), although the mean of ANC 4+ coverage of all countries was 57%, the proportion of women who received eight service components was zero in over one-third of the surveyed countries, from 20% to 40% in only four countries (Dominican Republic, Maldives, Colombia, and Nepal), with the rest of the countries equal to or less than 10% (12).

To effectively implement the specified antenatal care model, each country should be given the flexibility to prioritize essential interventions, delivering ANC that meets the needs of the local context and its capacity. Therefore, what can be observed from all of these studies, including ours, is that there is no consensus among countries on the number or type of specific components that should be delivered during ANC visits. The five components selected for this study were the consistent items that were included in all of these studies (12, 24, 25). For use in global comparisons, a similar course should be

followed: A composite indicator should be created of the most critical and common components of care to be monitored across all countries. Some important ANC-integrated interventions (such as intermittent preventive treatment in pregnancy, HIV counseling and testing, or intestinal parasite preventive treatment), which were included in the other studies but not ours, can be monitored separately for within-country use and/or for regional comparison.

The number of ANC visits does play an important role in influencing the quality of ANC received, as it provides opportunities to do the tasks that will help achieve the desired outcomes. Our findings were consistent with all previous studies indicating that women with at least four ANC visits had higher odds of receiving quality care (12, 24, 25). Therefore, “the proportion of women with ANC 4+ visits” is definitely a useful indicator to monitor the output or process of an ANC program. It is not, however, sufficient as a final summary indicator to evaluate a program’s impact or the outcome of delivering effective interventions during ANC.

We observed regional disparities in the quality of ANC in our study. Women living in the northern and southern mountainous areas were less likely to receive quality care, compared to those of the Red River Delta. Previous studies within Viet Nam have also found that these two mountainous and isolated regions were associated with limited access to maternal health care, including ANC utilization (18, 19, 28). As expected, maternal mortality and infant mortality rates were highest in these areas, compared to the national average (28). The concentration of minority ethnic groups in these areas and the high rates of poverty may be factors that contribute to these observations (19, 28). Thus, the national

policy makers and programmers in Viet Nam should have specific strategies that aim to improve access to quality ANC for women of these hard-to-reach areas.

Other social determinants of the receipt of quality ANC in Viet Nam were maternal education and wealth status. Women with at least a secondary level of education were more likely to receive all essential interventions during their pregnancy. In addition, women in the two richest wealth household quintiles also had greater chances of obtaining quality care, compared to the poorest. Both of these findings were in agreement with the outcomes of recent Nigeria and Nepal studies about the quality of ANC (24, 25). Consistent with the findings of earlier studies in Viet Nam, women with higher educational attainment or wealth status may have more knowledge and socioeconomic resources to empower them to gain access to, use, and thus improve their quality of ANC (15, 16, 20, 21, 29).

The greatest strength of this study is its use of data from a nationally representative survey, which makes it generalizable to the entire population. Our study could also be used for guidance in tracking and comparing ANC coverage and quality in future Viet Nam MICS surveys. However, there are a number of methodological limitations that need to be considered in interpreting our findings. The major limitation of this cross-sectional study design is that it is difficult to make causal inference between predictor variables and receipt of quality ANC. Second, the use of secondary data prevents our study from examining other factors that can affect the main outcome of interest. For instance, previous studies have found that maternal occupation or places of receiving ANC were significantly associated with the quality of care received (24, 25); however, this information was not collected from the Vietnam MICS 5. In addition, Viet Nam has a total of 54 different ethnic groups, and ethnic disparities have also been identified as important social determinants of

receiving ANC (16-18, 30). While ethnicity was a variable we considered, we could not explore this relationship very thoroughly because ethnicity was already dichotomized in the primary data as only Kinh and non-Kinh. Finally, information bias may affect our results, as the data were self-reported with no verification from medical records, and women might incorrectly recall the desired information within the two years preceding the survey.

CONCLUSION

Ending preventable maternal and child deaths will depend on our ability to deliver equitable and high-quality services to needed populations (8). This study reveals two important facts. First, less than half of Vietnamese women had received quality ANC as defined by services received, despite the fact that 80% of these women had been considered to have adequate ANC because they had received at least four ANC visits. This “quality-coverage” gap strengthens the evidence from an emerging body of research that calls for the development of a new, more effective coverage indicator that captures the delivery of high-quality services at ANC, not just mere contact, as a summary metric for overall ANC program performance (11, 12, 23-25). We have demonstrated that it is possible to develop such an indicator to assess the quality of a national ANC program using information available from national surveys and also that this can be comparable to both the local and global levels. In addition, inequity in quality ANC coverage, no matter how quality is defined, still exists among disadvantaged women in Viet Nam, as we have found from the most recent representative survey for the country. Providing quality ANC for all women will require national-level programmes that include a focus on underserved

populations who have low levels of education, lower wealth status, or live in mountainous areas. Further studies are needed to investigate the implementation barriers that may affect the capacity of the health care system to deliver high-quality ANC, as well as to examine what social and cultural barriers may influence women's decision to seek out and receive quality ANC care.

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APPENDIX

Table 1

Quality of antenatal care* received during last pregnancy (N = 1340)

ANC Components	Number	Percent	95% CI
Measurement of blood pressure	1144	86.1	83.6-88.3
Measurement of blood sample	833	64.9	61.4-68.3
Urine testing	967	75.3	72.2-78.2
Full protection against tetanus	1111	84.9	82.2-87.2
Iron-folate supplementation for 90+ days	1055	81.7	78.9-84.3
Had all the 5 critical components*	598	48.3	44.5-52.0

Source: The Vietnam 2013-2014 Multiple Indicator Cluster Survey 5

* Quality ANC was defined as full receipt of five ANC components (blood pressure measured, urine tested, blood sample taken, full protection against tetanus provided, and iron supplements provided for at least 90 days) that Vietnamese women received in their most recent pregnancy within two years preceding the survey.

CI = confidence interval

Table 2

Distribution of socio-demographic and reproductive health characteristics of the respondents, stratified by quality ANC received or not (N = 1340)

	Total		Quality ANC not-received		Quality ANC received**		p-value*
	N	%	N	%	N	%	
ANC characteristics							
Numbers of ANC visits							0.0001
< 4 times	325	21.7	276	79.6	49	20.4	
≥ 4 times	1015	78.3	466	44.0	549	56.0	
Timing of the ANC Initiation							0.0001
≤ 1 st trimester	1131	85.8	588	48.9	543	51.1	
> 1 st trimester	209	14.2	154	69.1	55	30.9	
Type of ANC providers							0.1073
Skilled providers	1336	99.8	738	51.7	598	48.3	
Unskilled providers	4	0.2	4	1	0	0	
Socio-demographic variables							
Residence							0.0001
Urban	536	30.6	244	41.3	292	58.7	
Rural	804	69.4	498	56.4	306	43.6	
Region							0.0001
Red River Delta	221	24.7	107	49.4	114	50.6	
Northern Midlands and Mountainous area	219	13.2	164	77.2	55	22.8	
North Central and Central coastal area	216	21.8	117	55.0	99	45.0	
Central Highlands	262	6.8	209	81.8	53	18.2	
South East	229	16.8	55	24.4	174	75.6	
Mekong River Delta	193	16.7	90	51.8	103	48.2	
Household wealth quintile							0.0001

Poorest	249	15.7	206	76.9	43	23.1	
Poor	251	20.5	166	63.0	85	37.0	
Middle	261	21.0	155	55.3	106	44.7	
Rich	299	22.8	138	41.6	161	58.4	
Richest	280	20.0	77	28.3	203	71.7	
Ethnicity							0.0001
Kinh	1103	87.4	539	47.4	564	52.6	
Non-Kinh	237	12.6	203	81.9	34	18.1	
Education							0.0001
None or Primary	182	12.6	137	68.9	45	31.1	
Secondary	830	62.3	482	54.7	348	45.3	
Higher	328	25.1	123	35.9	205	64.1	
Parity							0.0001
≤ 2 children	1145	85.7	600	48.9	545	51.1	
> 2 children	195	14.3	142	68.8	53	31.2	
Age							0.3314
15-19	81	5.2	57	60.8	24	39.2	
20-35	1144	86.6	621	51.0	523	49.0	
36-49	115	8.2	64	53.7	51	46.3	
Sample Size (N)	1340	100.00	742	51.8	598	48.2	

Source: The Viet Nam 2013-2014 Multiple Indicator Cluster Survey 5

N = frequency; % = percent. *p-value from the Pearson chi-square test

** Quality ANC was defined a full receipt of five ANC components (blood pressure measured, urine tested, blood sample taken, full protection against tetanus provided, and iron supplements provided for at least 90 days) that Vietnamese women received in their most recent pregnancy within two years preceding the survey.

Table 3**Factors associated with the receipt of quality ANC+ in Viet Nam (N = 1340)**

	Unadjusted		Adjusted	
	Odds Ratio (95%CI)	p value	Odds Ratio (95%CI)	p value
ANC characteristics				
Numbers of ANC visits				
< 4 times	Reference		Reference	
≥ 4 times	4.96 (3.43-7.16)	***	2.47 (1.66-3.67)	***
Timing of the ANC Initiation				
1 st trimester	Reference		Reference	
1 st trimester	0.43 (0.29-0.62)	***	0.88 (0.57-1.37)	
Socio-demographic variables				
Residence				
Urban	Reference		Reference	
Rural	0.54 (0.40-0.74)	***	1.16 (0.82-1.64)	
Geographical region				
Red River Delta	Reference		Reference	
Northern Midlands and Mountainous area	0.29 (0.17-0.48)	***	0.55 (0.32-0.97)	*
North Central and Central coastal area	0.80 (0.52-1.23)		1.25 (0.94-2.21)	
Central Highlands	0.22 (0.13-0.36)	***	0.46 (0.27-0.77)	**
South East	3.02 (1.82-5.01)	***	3.56 (2.19-5.79)	***
Mekong River Delta	1.14 (0.70-1.85)		2.08 (1.26-3.41)	**
Household wealth quintile				
Poorest	Reference		Reference	
Poor	1.95 (1.22-3.12)	**	1.24 (0.74-2.09)	
Middle	2.68 (1.67-4.31)	***	1.56 (0.91-2.67)	

Rich	4.66 (2.85-7.60)	***	2.10 (1.18-3.72)	*
Richest	8.41 (5.10-13.89)	***	3.02 (1.54-5.94)	**
Ethnicity				
Kinh	Reference		Reference	
Non-Kinh	0.20 (0.12-0.33)	***	0.70 (0.37-1.35)	
Education				
None or Primary	Reference		Reference	
Secondary	1.83 (1.27-2.65)	**	1.94 (1.29-2.92)	**
Higher	3.95 (2.57-6.07)	***	2.56 (1.52-4.33)	***
Parity				
≤ 2 children	Reference		Reference	
> 2 children	0.43 (0.30-0.64)	***	0.64 (0.41-1.02)	
Age				
15-19	Reference			---
20-35	1.49 (0.64-1.94)			
36-49	1.34 (0.68-2.64)			

Source: The Viet Nam 2013-2014 Multiple Indicator Cluster Survey 5

+ Quality ANC was defined as a full receipt of five ANC components (blood pressure measured, urine tested, blood sample taken, full protection against tetanus provided, and iron supplements provided for at least 90 days) that Vietnamese women received in their most recent pregnancy within two years preceding the survey.

* p < 0.05, ** p < 0.01, *** p < 0.001, CI = confidence interval